

ADJUSTABLE AND FOLDABLE STEM AND BEARINGS FOR WHEELED VEHICLES

I. BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

This invention relates to a bicycle stem that can be raised and lowered to adjust the handle bar height and rotated 90 degrees and then folded down so that the handle bar is close to and parallel to the frame of the bicycle for storage. The stem works simply and safely with threaded or threadless steerer tubes using a minimum of materials and parts which are basically standard to the industry.

2. PRIOR ART

Bicycles and other wheeled vehicles are often only used occasionally and stored frequently. Yet, due to the laterally protruding handlebars, storage is not particularly convenient. To date, there have been no successful foldable handlebars to alleviate this problem. In addition, consumers are demanding more comfortable bicycles with highly adjustable handlebar positions. In recent years, a large number of adjustable stems have entered into the marketplace. These stems are, for the most part, quite heavy and only adjustable using a tool. In the prior art, there have been no stems whose height is adjustable by hand, that fold-down or that are safe, strong and not too heavy. A great number of stems have focused on being light and strong with U.S. Patent 5,095,770 representative of those proposals but, all are very limited in use by not

being adjustable in height by hand, and do not even consider a storage fold-down feature. U.S. Patents 5,517,878, 5,540,457, 5,588,336, 5,687,616, 5,680,798 and 5,865,069 show stems that have become progressively heavier and more complicated without offering any adjustability, fold-down, or other meritorious features. U.S. Patents 5,737,967 and 5,727,427 with partially folding stems, address the question of storability. U.S. Patent 5,737,967 has the handle bars fold in half and back. These are held by a heavy non-adjustable stem. U.S. Patent 5,727,427 rotates the handle bars 90 degrees to a vertical position in a questionable manner.

The techniques for producing a fully folding stem have in the past been limited to employing a single fixed skewed exterior hinge which in the folding process carried the handle bars through both a 90 degree turn and a drop-down of 90 degrees so that they end up parallel to and close to the frame of the bicycle. In some cases in order to end up in this same parallel position, the stem was rotated up and then down through 270 degrees which achieved the same results.

In all cases, the fundamental principle was that by positioning the hinge in one fixed skewed position, the folding process could be done with a single motion. Although this seems a simpler concept than dividing the folding motion into two parts as done in accordance with this invention, it relies on concept which weakens the stem in the rideable position. That is, a hinge becomes a structural component of the stem when the vehicle is being ridden and this weakens the stem. No matter how well the hinge is made, it allows motion between the connected parts which translates into unwanted motion in the handlebar during riding and weakens the performance of the bicycle. In addition, when the hinge is skewed to one side it creates an unbalanced fastening situation. Finally, when a single rotation of the handle bars is up, back over, and down to reach the folded position, the length of the brake and the derailleur cables

must be extra long to handle this extended travel. U.S. Patents 5,269,550 and 5,440,948 with their rear hinges show all these defects, and require a tool to operate.

None of the prior art incorporates methods that allow for user error. In many cases, after folding, the handlebar and stem assembly may appear to be ready to be ridden but in fact is not locked into place. Consequently, there is a serious safety issue in these prior art mechanisms.

II. SUMMARY OF INVENTION

To overcome the above-noted defects in the prior art, this invention uses a very simple, exterior mounted locking means on the extended threaded or threadless steerer tube. It keeps the interior of the steerer tube clear, and employs an interior, hand-adjustable, full range height adjusted stem and handle bar. The invention uses the extended steerer tube for strength and does not use the pivot hinge as a structural member during riding by placing the folding hinge inside or as part of a non-stressed outside position for safety. The invention is accomplished with a minimum of materials, using those that are standard with the industry. Implementation of the invention is extremely easy to use the very first time – simply unlock by hand, lift, turn, and fold down, Finally the invention works on standard large or small wheel folding or non-folding bicycles.

It is the objective of this invention to define a safe, adjustable, folding stem for a bicycle, a folding bicycle, a motor bicycle, or other wheeled vehicle. This invention comprises a stem which can be adjusted in height without the use of tools, and which can be easily folded down and out of the way for storage. The folding process is accomplished simply by unlocking a quick release, lifting the stem, rotating it approximately 90 degrees, and folding it downward. A frame mounted bracket could be included to hold the handlebar in the folded position.

The invention employs a stem section holding the handlebars at one end and a pivoted and hinged mechanism at the other end which is restrained from pulling out or off the steerer tube. This stem section is able to rotate 90 degrees and in addition, drop down 90 or more degrees so that the handle bars in the folded position are set close to and approximately parallel to the frame of the bicycle.

While performing the fold-down feature the handle bars and interior stem are adjustable by hand for different riding heights. Both interior and exterior hinges include a safety feature against lateral turns with their grooved construction, and a safety feature against folding down during riding by using the interior and exterior surface of the extended steerer tube to prevent the hinging motion, meanwhile remaining light in construction and easy to build.

Using the interior hinge, the steerer tube is fixed onto the stem using a standard slotted clamping device with a quick-release. This clamping collar is bolted to the steerer tube or for threaded steerer tubes, is threaded, then bolted on. Because this clamping collar has protrusions that fit into the stem's continuous slots, it permits the stem to be raised and lowered while always keeping its alignment. This allows the rider to steer the bicycle even if he or she forgets to lock the quick release clamping device. When the stem is pulled all the way up where the protrusions come out of the slots, the stem can be rotated. At this point the hinge is outside the headset and the bottom section of the hinged stem hits the protrusions forcing it to remain inside the steerer tube.

The means of hinging can be as flexible as a bungee cord or rigid using pinned metal construction. The final positioning of the handle bars is determined when using interior metal hinges by: (a) the length of the vertical and forward-thrust sections of the stem; (b) the basic alignment offset between hinge and the line of the bicycle; (c) the amount of skewing to the side

- (c) of the hinge; and (d) the angle of rotation before folding down and the amount of fold-down.
- 12 The handlebars may end up on either side of the vehicle at a wide range of angles. All these are
- 13 adjusted for folding, non-folding, large wheel or small wheel bicycles. Minor adjustments are
- 14 made for when a threaded or threadless steerer tube is used, but in general, the threaded
- 15 construction has a smaller and lighter locking nut and washer than the three-part locking
- 16 necessary for the threadless construction.

When the rotating quill device is used, the interior bolt, as in a standard quill is tightened and draws the sloping surfaces against one another jamming the quill section against the inside of the steerer tube, thus locking the headset. To fold this version, the sloping (approximately 45 degrees) surfaces rotate relative to one another forming approximately a 90 degree fold.

11 IV. BRIEF DESCRIPTION OF THE DRAWING

12 Figure 1 is a perspective view with a pulled-up and then folded steering assembly using a
13 threadless steerer tube;

14 Figure 2 is a bottom view section through the hinge area;

15 Figure 3a is a front view of the hinge area,.

16 Figure 3b is a front view of a skewed hinge;

17 Figure 3c is a front view of the hinge area with a elastic cord;

18 Figure 4a is a top view of the top collar showing the hinge mechanism;

Figure 4b is a side view section through a threadless steerer tube with a headset quick release collar with the stem not illustrated;

Figure 4c is a view of the tightening flange for a threadless steerer tube;

Figure 4d is a view of the headset threaded flange for a threadless steerer tube;

Figure 4e is a side view section through the threaded steerer tube without the stem;

Figure 4f is a view of one embodiment of the threaded top quick release clamping collar;

Figure 4g is a view of the headset top nut set with a gap between it and the top quick release clamping collar for threaded steerer tube;

Figure 4h is a view of the threaded steerer tube standard headset washer;

Figure 5a is a side view section of the angled headset showing the folded stem beyond parallel to the bicycle;

Figure 5b is a top view of the angled headset showing the folded stem beyond parallel to the bicycle;

Figure 6a is a side view of the front end of a bicycle showing the folding stem raised out of the headset;

Figure 6b is a side view showing the raised folding stem turned 90 degrees;

Figure 6c is a side view showing the folding stem folded down parallel to the bicycle;

Figure 6d is a side view showing the 22 degree offset-hinge folding stem folded down parallel to the bicycle;

Figure 6e is a side view showing the offset-hinge folding stem folded down parallel to a center fold folding bicycle;

Figure 6f is a side view showing the offset-hinge folding stem with a seat tube fold on a folding bicycle;

Figure 7a is a side view section of a composite ride and fold position illustration of a threadless steerer assembly with a stem quick release surround;

Figure 7b is a partial front view of Figure 7a;

Figure 8a is a side view section showing the folded position of a threadless steerer tube with an exterior hinge;

Figure 8b is a partial front view of Figure 8a in the riding position;

Figure 9a is a side view showing the folded position of a threadless steerer tube with an exterior hinge and star nut;

Figure 9b is a front view of Figure 9a;

Figure 10a is a front view of a rotating quill interior hinge design in the folded position with the handle bars parallel to the bicycle;

Figure 10b is a front view of a rotating quill interior hinge design in the unfolded, raised position with the handle bars rotated to the opposite side;

Figure 10c is a side view of a rotating quill interior hinge design in the riding position with the entire quill and handle bars turned to the front, in the riding position; and

✓ Figure 11 is a side view of a rotating quill design with the hinge located below the quill.

V. DESCRIPTION OF THE PREFERRED EMBODIMENTS

In all of the embodiments, the parts which raise and lower with the stem are designated with odd numbers and the fixed stem parts and bicycle connecting parts are designated with even numbers. In Figure 1, the vehicle head tube 10 holds the standard top and bottom bearings 8 and 12 of a standard threadless headset. The top clamping collar 26 is bolted to the steerer tube. Below the clamping collar, as illustrated in Figure 4b but shown in Figure 1, is the smooth interior-threaded exterior flange 22 that has a tooth projection 24 which fits up into the quick release slot of the upper collar. Threaded on this flange is an adjuster-tightening flange 18 with wrench slots 20 which tightens down onto the slotted clamp 14 with its Allen key bolt 16. This

pressure adjuster system is clearly shown in Figure 4b which illustrates the quick release 28, slot 30, and nut 32 on the slotted collar 26 secured to the steerer tube 6 with the set screw 36.

The clamping collar, as shown in Figure 4a, has projection 38 which guides the vertical section of the stem. In Figure 1, the top and bottom vehicle tubes 40 and 42 complete the fixed elements.

Figure 1 along with Figures 4a, 4b, 4c and 4d illustrate an adjustable folding stem used with a standard threadless steerer tube and headset. Figures 4e, 4f, 4g and 4h show a threaded steerer tube setup and this head set construction can be substituted for 4a, 4b, 4c and 4d using the same stem as shown in Figure 1. Figure 4e shows the steerer tube threaded all the way down to the top race 108 which is wedge fit into the outer head tube 10. The ball bearings 106 ride between the race 108 and the upper bearing cup 104 which is threaded onto the steerer tube 6. The standard head set washer 92 shown in Figure 4h with inward set tooth 94 slides down on the bearing cup 104, its tooth 94 fitting in the groove 96 below the slot 34 which as the arrow indicates belongs under the collar quick release slot shown on Figure 4f.

Figure 4g shows the standard headset nut 90 which tightens down onto to the bearing construction but does not touch the top collar 98 shown in Figure 4f. This collar 98 is threaded onto the top thread portion 100 of the steerer tube and is correctly secured so the projections 38 are perpendicular to the bicycle with the small bolt 36 coming through the hole 102.

In Figure 1 the stem is shown pulled all the way up ready to turn and fold. The bottom plug 1 of the lower part of the stem cannot be raised higher because of the collar 26 projections 38. When the lower tooth of the hinge 3 is rotated it does not hit the projections 38. The lower tooth 3 is pinned to the upper teeth 7 with the pin 5. The vertical stem 9 can be of varying lengths depending on the range of adjustability desired and whether it is used with large or small

wheel bicycles. The indentations 11 house the collar projections 38 and keep the stem from rotating in case binder 28 is not locked during riding. The standard stem forward thrust member 13 holds the standard clamp 15 and handle bars 17.

Figure 2 is a bottom sectional view looking up showing the 22 degree offset between the hinge direction and the forward-thrust stem section. Variations of the 22 degree angle change the folded position of the handlebar. If the 22 degrees is reduced to zero, the handlebars will end up folded perpendicular to the steerer tube. A negative angle can also be used to position the folded handlebars on the opposite side of the bicycle. Figure 3a is a front view of the hinge construction showing the skewed stem slots 11. Figure 3b is a front view of the hinge construction showing the variation of skewing the hinge to change the position of the folded members. Figure 3c shows the introduction of an elastic chord 35 to replace the hinge in a less expensive model.

Figure 5a is a side view using the threadless head set and stem construction of Figures 4a, 4b, 4c and 4d and with the stem and handle bars in a folded position parallel to the bicycle. As shown in Figure 5a the 22 degree skewed angle of hinge with vertical stem section 9 in a horizontal position causes the throw section of the stem 13 to drop vertically and the handle bars to be approximately parallel to the ground as shown also in Figure 6d. Figure 5b is a top view of Figure 5a.

The diagrams of Figure 6a through 6f show the handle bar positioning as it relates to folding and non-folding bicycles. Figure 6a is the diagram as shown in Figure 1 with the handle bar and stem pulled all the way up. Figure 6b shows the handle bar rotated 90 degrees. Figure 6c shows the handle bar folded down and perpendicular to the head set as if the offset angle were zero. Figure 6d shows the handle bar folded down and parallel to the ground as if the offset angle were 22 degrees. Figure 6e shows the same fold but used with a center folding bicycle

with the front and back wheels lined up, and Figure 6f shows the same with a seat tube folding bicycle with the front wheel removed. The standard front frame construction is made up of the top tube 40, down tube 42, and seat tube 54 with crank 60 and chain wheel 62. The center fold bicycle shown in Figure 6e has a center bar 44, a center member 50, a center pivot 52, and a seat tube restraint plate 46 with locking bolt 48. The back frame has seat stay 70 and chain stay 72 holding rear axle 74 and rear wheel 76. In Figure 6f, the seat tube fold has top and bottom seat tube collars 56 and 58.

Figure 7 illustrates a second embodiment which employs an extended steerer tube and an internal hinge, but does not slot the upper steerer tube for clamping on to the stem. Figure 7a shows a standard threadless steerer tube with a threaded slotted locking nut 22 tightened onto the steerer tube and threaded onto a second slotted locking nut 18 which applies pressure on the standard threadless headset bearing member 12. As in the other configurations illustrated in Figures 1 to 6, the steerer tube extends beyond the bearing for locking and securing the folding stem. In the case of Figure 7a, however, the locking quick release rides with the vertical folding stem section 21 with slotted area 19 which wraps around and is squeezed onto the steerer tube 6.

A wedge 33 is pinned to the steerer tube and the member 21 has a wedge slot that fits onto this during riding to prevent rotation in case the quick release is not tightened during riding. This wedge and slot are clearly shown in the front view in Figure 7b but could be replaced with the channel 11 and protrusions 38 of Figure 1. Figures 7a and 7b show a folding, non-adjustable stem. However, if the steerer tube was threaded on the inside and an additional inside threaded tube were added, this tube could house the smaller diameter vertical stem and telescope up to adjust the handle bar height.

Figure 8 shows a third embodiment which employs the extended steerer tube found on other embodiments but in this case the top is not slotted and there is no internal hinge. Figure 8a is a front view of a folded threadless steerer tube with an exterior collared vertical upper stem section 19 and lower section 27 raised and lowered onto the steerer tube and hinged at 25, stopped from pulling out with pin 29 and having a handle 31. As shown in Figure 7a, a locking and tightening threaded nut and flange apply pressure on the bearing set. Figure 8b shows the locked riding position of Figure 8a. Figure 9a is a threadless steerer tube with the same folding system but with a star-nut head set construction in lieu of the standard flange and nut of Figure 7a. Figure 9b illustrates the riding position of this embodiment.

Figure 10 shows a fourth embodiment which employs the internal hinge concept of other embodiments, however, it uses a quill type method for locking and it does not use the extended steerer tube used in all other embodiments. Figure 10a shows the handle bar in the folded position parallel to the bicycle. The upper section of quill stem 9 has the continuous anti-rotation slots 11 on each side and allen key or quick release 37 tightens the hinge quill bolt 39, turning in the threaded section 41. This is attached to the upper hinge section 7 with pins to lower section 3 which is part of the bolt 43 which is screwed in to the lower section of the quill 45 which is partially slotted 11 as shown. When folding the stem, the lower quill section 45 is being pulled up it is stopped by a protrusion collar 49 which has been screwed onto and pinned to the standard top threaded nut 22 after it has been set. These protrusions and slots are an alignment guide for the head set and are optional.

Figure 10b shows the handle bar rotated 180° to the opposite side. Since bolt 39 rotates freely with respect to the upper quill section 9, it and the hinge and the lower section 43 can remain unturned always aligned with the quill 45° sloping surfaces. The next step is the entire

quill stem is turned 90° to face front. Figure 10c shows the side view with bolt 39 tightened down in the threading 41 activating the sliding quill action and securing the handle bars in the standard manner.

Figure 11 shows the entire hinge mechanism set below and attached to the bottom section 45. Again the protrusions and slots would be optional.

It will be appreciated that modifications of this invention may be practiced without departing from the scope of this invention. For example, the quick release used in the embodiments could be replaced by a bolt or wing nut or other tightening technique.